Thin electrolyte thickness measurements for atmospheric corrosion modelling

Koushik Bangalore Gangadharacharya, Nils Van den Steen, Daan De Wilde, Darja Pecko, Raf Claessens, Herman Terryn
Research Group Electrochemical and Surface Engineering, Department of Materials and Chemistry, Vrije Universiteit Brussel, Brussels, Belgium

Abstract

The evolution of geometric thickness of a thin electrolyte layer (TEL) on the metal surface, due to condensation/evaporation of moisture in the air, is one of the prime factors influencing the corrosion rate. The dynamic variation of thickness is mainly caused by varying surface temperature, environmental relative humidity and temperature. Additionally, the presence of hygroscopic salts also has a major impact on the condensation/evaporation dynamics. In order to quantify their influence, experiments are conducted under strict environmental control to directly measure the thickness evolution of uniform TEL under condensation and evaporation regimes. The experimental results are used to validate the Dynamic Electrolyte Film Model (DEFM), which forms the primary part of the atmospheric corrosion model developed in our group [1]. DEFM numerically simulates the thickness evolution of a uniform TEL due to condensation/evaporation of moisture, both with and without the presence of hygroscopic salts. A continuous measurement of thickness variation as function of surface temperature is attempted using interferometry. Both condensation and evaporation of TEL is promoted by varying the surface temperature below and above the dew point for a given environmental relative humidity and temperature.

Reference